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ABSTRACT

This instructional modular unit with instructor's guide provides materials on aspects of one of the major systems of the human body--the respiratory system. Its purpose is to introduce the student to the structures and functions of the human respiratory system--and the interrelationships of the two--and to familiarize the student with some of the terms and concepts necessary for an understanding of the respiratory system. The modular unit is made up of several components: a pretest; four instructional modules with objectives, informative materials, and corresponding post-tests; optional activities for the students; and a glossary of terms used in the unit. Topics covered in the modules include an introduction to the respiratory system, upper respiratory tract, the lungs, and respiration. The instructor's guide provides suggestions for effective use of the materials, including descriptions of each component, use of the components, scoring the post-tests and answers to the post-tests. Three additional modules on the circulatory, musculoskeletal system, and digestive systems are available separately (see Note). (YLB)

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ED186693

Instructional Materials in Anatomy and Physiology
for Pennsylvania Health Occupations Programs

THE RESPIRATORY SYSTEM

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U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

PREFACE

An understanding of basic human anatomy and physiology is essential to any person preparing to enter a health occupation. This instructional unit is designed to introduce you to the structures and functions of the human respiratory system--and the interrelationships of the two--and to familiarize you with some of the terms and concepts necessary for an understanding of the respiratory system.

This unit consists of a pretest; four modules with their optional activities and post-tests; and a glossary of terms.

Begin this modular unit by taking the brief pretest at the front of the booklet. The pretest is for your use only, to give you an idea of what is included in this unit, and to give you an indication of the areas within the unit to which you should pay special attention (perhaps by working on the optional activities). When you have completed the pretest, turn to the answers in the back (page 29) to check your own score. You will not be graded on the pretest.

Next, read through each of the modules (Introduction to the Respiratory System, Upper Respiratory Tract, The Lungs, and Respiration) and investigate any of the optional activities that may be helpful or interesting to you. The optional activities will help you learn more about some of the material presented.

At the end of this unit (page 27) is a glossary which provides you with brief definitions of many of the terms used in the modules.

Upon completion of each module, you should be able to demonstrate an understanding of the material presented, by your performance on the post-test. When you have finished a module and feel that you understand the information in that module, take the post-test that follows it. Write down your answers on ONE piece of paper and pass it in to your instructor, who will give you your grade.

PRETEST

1. Which of the following is a part of the respiratory system?

   A. heart
   B. brain
   C. lungs
   D. liver

2. Which of the following is removed from the blood through respiration?

   A. hemoglobin
   B. carbon dioxide
   C. glucose
   D. erythrocytes

3. The main function of the respiratory system is to provide the blood with _____.

4. During inspiration, air first passes through the:

   A. bronchi.
   B. alveoli.
   C. lungs.
   D. nose.

5. The pairs of hollow chambers surrounding the nasal cavity are called _____.

6. Which of the following is found in the larynx?

A. vocal cords
B. bronchi
C. turbinates
D. sinuses

7. The structures in the throat that vibrate to produce sounds are the

_____.

8. The two passageways that split from the trachea and lead to the lungs are called

_____.

9. The primary muscle involved in breathing is the:

A. pleura.
B. diaphragm.
C. pharynx.
D. trachea.

10. Name the two major types of respiration.

_____

_____

INTRODUCTION TO THE RESPIRATORY SYSTEM

Goals

Upon completion of this module, you should be able to:

1. Identify the components of the respiratory system.
2. Identify the major functions of the respiratory system.

COMPONENTS OF THE RESPIRATORY SYSTEM

The respiratory system is the system of the body that we are probably most aware of in our daily activities. Hard exercise, chest colds, stuffy rooms, and frosty mornings make us aware of the actions of the respiratory system and the need for its constant and efficient functioning.

Although the human body can survive for a considerable period of time without some of the materials necessary to support life (such as food and water), it cannot survive for more than a few minutes without oxygen. Deprived of a supply of oxygen, the cells of the body will soon begin to die. Two systems in the human body serve the critical function of bringing oxygen to the cells: the circulatory system, which is the system of transport (the circulatory system is the subject of another unit), and the respiratory system, which provides oxygen to the circulatory system.

The respiratory system consists of two major divisions: conducting organs and gas exchange organs. Essentially, the conducting organs (upper tract) form a tube opening to the outside environment to permit airflow to and from the lower area. This tube includes the nasal cavity, pharynx, larynx, and trachea.

Gas exchange occurs in the lungs. In the lower area, multiple branchings of the passageways lead to the lungs and the organs where gas exchange occurs: the alveoli, which are the functional units of the respiratory system. Also important to the respiratory process are the structures associated with the lungs: the pleurae, the chest wall and ribcage, and the diaphragm and muscles that aid in the mechanical process of breathing.

Figure 1 shows the structures and organization of the respiratory system.

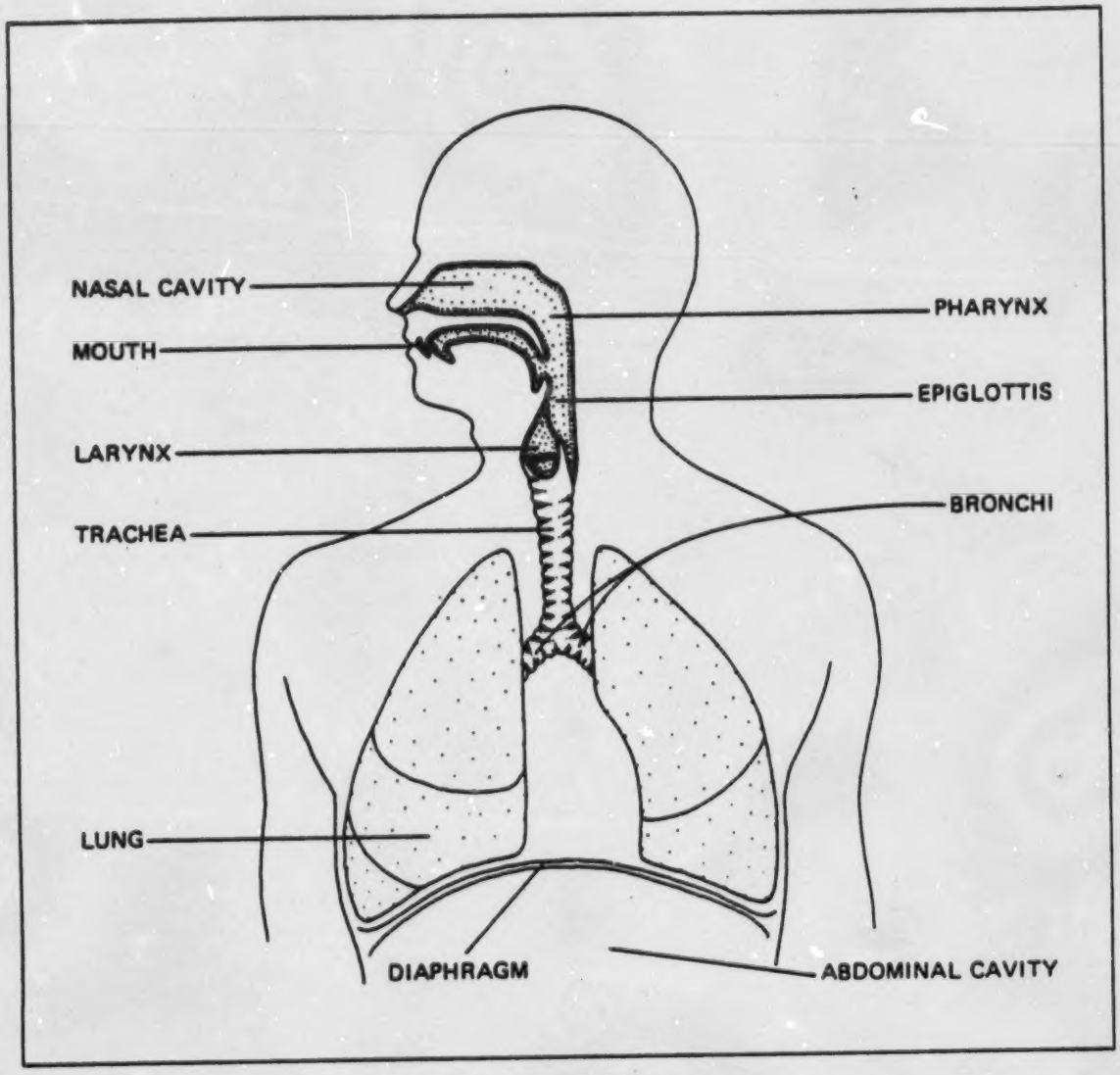

Figure 1. The Respiratory System

FUNCTIONS OF THE RESPIRATORY SYSTEM

Breathing is a cycle that begins with inspiration, or taking in air. Next follows a two-way exchange: oxygen passes from the lungs into the bloodstream and carbon dioxide passes from the bloodstream into the lungs. Carbon dioxide is a waste product of normal cell functioning (metabolism) and must be vented from the body by expiration, or exhaling. In fact, breathing is triggered when carbon dioxide concentration in the blood reaches a certain level; the body breathes in order to eliminate carbon dioxide as well as to take in oxygen. The cycle of inspiration-expiration (respiratory rate) is triggered about 10-14 times per minute in a resting adult and about 20 times per minute in a child. The rate of respiration depends largely on body demands. As body activity increases, so does the utilization of oxygen and the production of carbon dioxide. When the trigger level of carbon dioxide is achieved more rapidly, breathing becomes faster and deeper.

Because the respiratory system is open to the outside environment (through the nose and mouth), it is susceptible to particles and bacteria in the air. Pollutants and microorganisms are taken in with every breath of air. Secretions produced by the respiratory tract trap and engulf the particles and pollutants, and even contain enzymes which destroy bacteria. In this way the respiratory system protects the body from constant exposure to harmful particles, while carrying on the process of supplying the body with the oxygen necessary to maintain life.

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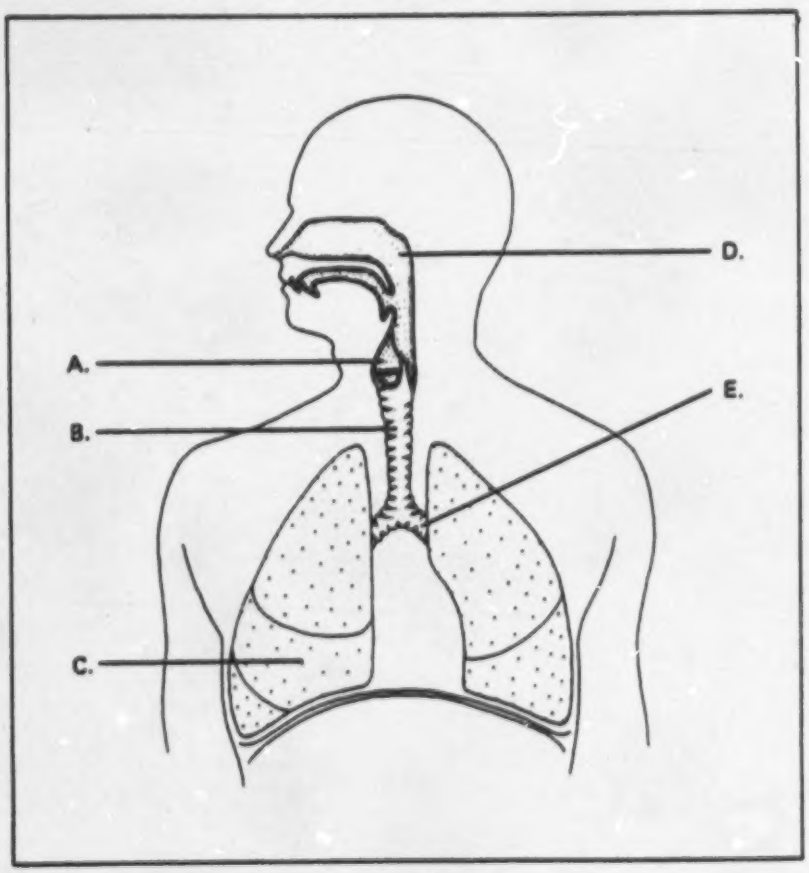
INTRODUCTION TO THE RESPIRATORY SYSTEM

Post-Test

1. Match the parts of this diagram (indicated by letters, A-E) to the names of the organs. (One of the letters will not be used.)



____ trachea

____ larynx

____ bronchus

____ lung

2. The two major divisions of the respiratory system are:

   A. conducting organs and gas exchange organs.
   B. the pharynx and the larynx.
   C. organs of support and organs of movement.
   D. the trachea and the bronchi.

3. In the lower respiratory tract, gases are exchanged between the lungs and bloodstream in the:

   A. diaphragm.
   B. trachea.
   C. pleurae.
   D. alveoli.

4. Which of the following is NOT a component of the respiratory system?

   A. esophagus
   B. pharynx
   C. larynx
   D. nasal cavity

5. The upper respiratory tract has the ability to:

   A. exchange gases with the blood.
   B. transport oxygen to the brain.
   C. purify air that is inhaled.
   D. produce oxygen for the lungs.

6. Breathing is directly triggered by high carbon dioxide concentrations in the:

   A. nasal cavity.
   B. lungs.
   C. blood.
   D. muscles.

UPPER RESPIRATORY TRACT

Goals:

Upon completion of this module, you should be able to:

1. Identify the structures of the nose.
2. Describe the functions of the nose and its related structures.
3. Identify the structures of the pharynx, larynx, and trachea.
4. Describe the functions of the pharynx, larynx, and trachea.

Air enters the body through the upper respiratory tract, which includes the nose, pharynx, larynx, trachea, and bronchi. Each of these organs is uniquely equipped to help provide the lungs with properly conditioned air and to maintain the flow of air through the system.

THE NOSE

The nose is the first organ of the respiratory system. Its external openings, the nostrils or nares, lead backward into the nasal cavities, which are separated by a wall of cartilage and bone called the septum. On the side walls of the nasal cavities are the turbinates, spiral passageways which hang like "sagging shelves" in the path of incoming air. Hollow chambers within the facial bones called sinuses surround and open into the nasal cavities. The sinuses and walls of the nasal cavities are lined with mucous membranes containing cilia, which are microscopic hair-like structures on the surface of the mucous cells. These cilia are constantly in motion; they beat back and forth about 10-12 times per second. Ciliated mucous membrane extends through the entire upper respiratory tract and, as will be discussed, has an important function.

In addition to providing the initial openings to the outside air, the nose has other functions. Nerve endings in the roof of the nasal cavities are responsible for the sense of smell, or olfaction. Olfaction can serve a protective function by warning the body of air possibly unsuitable or dangerous to breathe.

In another function, the nasal cavities act as a sort of "air conditioner": they condition the air going to the lungs. The temperature and humidity of the air in the environment vary a great deal as compared to the fairly constant conditions within the body; inspired air could dry out or freeze the delicate lung tissue were it not for the fact that the air must first pass the turbinates and mucous membranes. As air entering the body passes over and through these structures, it becomes warmed and moistened almost to the level of the temperature and humidity inside the lungs.

Also, the nasal cavities filter and clean the air going into the respiratory system. Mucus, a thick and sticky fluid produced by the mucous membranes, traps incoming particles. If the respiratory tract were not lined with cilia, the mucus would quickly become covered with trapped material and thus lose its moistening and protective properties. But the constant waving motion of the cilia moves the mucus to the pharynx where, together with the trapped foreign matter, it is swallowed—and later disposed of by the stomach. In the rest of the upper respiratory tract, the cilia carry mucus and the filtered-out substances toward the pharynx constantly, like a downward escalator.

THE PHARYNX

The pharynx is the throat, a cavity extending from behind the nasal cavities down to the larynx. Because it is an area common to both the digestive and respiratory systems, the pharynx is ideal for disposing of the particle-filled mucus sent to it by the ciliary escalator. The pharynx also completes the task of warming and moistening the inspired air, which was begun in the nose. At the base of the throat the pharynx opens to the larynx, or voicebox; at the back of the neck it leads to the esophagus, the tube which carries food to the stomach.

THE LARYNX

A rigid, box-like structure made of sturdy plates of cartilage, the larynx houses and protects the vocal cords. We can speak and make sounds because of our vocal cords, which use their ability to contract, combined with the controlled exhaling of air, to produce different vibrations that result in sound. The vocal cords also guard the opening to the trachea, a large tube of the upper respiratory tract. Between the cords is a slit called the glottis, which leads into the trachea. Should anything intended for the esophagus (like food or water) accidentally enter the larynx, the glottis can close shut to seal off the lower respiratory tract. Also, the epiglottis, an elastic flap of tissue, folds over the glottis to seal it off when food or liquid enters the pharynx. In this way the larynx protects the respiratory tract from taking in anything except air.

THE TRACHEA

The last passageway of the upper respiratory tract is the trachea, or "windpipe," a short tube about five inches long and one inch in diameter which links the pharynx and the lungs. It is made of about 20 C-shaped rings of cartilage, stacked one on top of another and joined together by tough connective tissue. Cartilage provides rigidity and protection which allows the passageway to remain open regardless of the position of the head and neck. Although the C-shaped cartilage is rigid, the back of the trachea, where it lies against the esophagus, is soft. This allows for expansion of the esophagus when food is passing through.

The trachea is the end of the upper respiratory tract. It leads to the lungs, where the actual respiration takes place.

Figure 2 shows the structures of the upper respiratory tract.

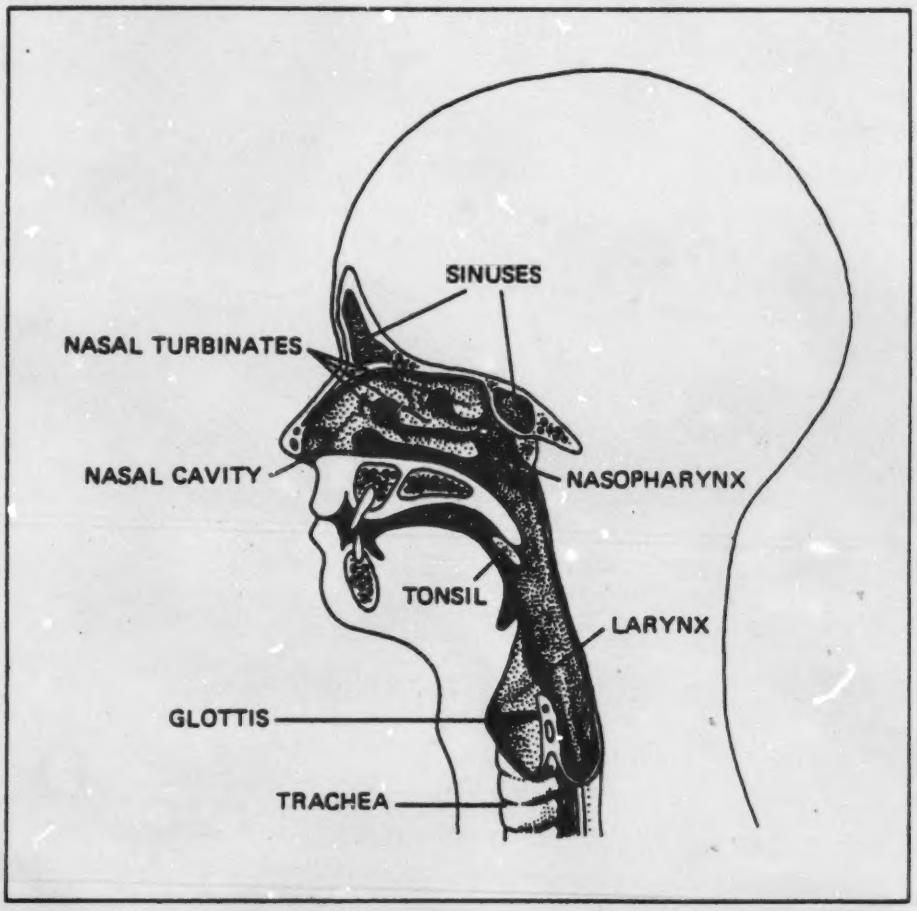


Figure 2. The Upper Respiratory Passages

Optional Activities

- Look at the structure of the cilia under a microscope, or view slides of cilia.
- Discuss what actually happens when food "goes down the wrong way."
- Find out about the emergency procedures and techniques to apply when someone is choking.

UPPER RESPIRATORY TRACT

Post-Test

1. The hair-like structures within the mucous membranes of the nose are called _____.

2. A major function of the nose is to:

   A. effect gas exchange.
   B. moisten air.
   C. produce blood cells.
   D. protect the sinuses.

3. The sense of smell is also known as:

   A. olfaction.
   B. turbinate.
   C. cilia.
   D. gustation.

4. Mucus is produced by mucous membranes in the:

   A. lungs.
   B. alveoli.
   C. sinuses.
   D. esophagus.

5. Structures of the nose serve a protective function by:

A. preventing food from entering the trachea.
B. warming air entering the body.
C. removing poisonous substances from the blood.
D. preventing carbon dioxide from entering the lungs.

6. The nose is divided into two nostrils by a:

A. bronchiole.
B. septum.
C. cavity.
D. sinus.

7. Which of the following is NOT a conducting organ of the respiratory system?

A. pharynx
B. trachea
C. alveolus
D. larynx

8. The passageway that connects the nasal cavity and the larynx is the

_____.

9. The trachea is a protective structure because it is made up of:

A. bones and fatty tissue.
B. C-shaped rings of cartilage.
C. blood vessels and ligaments.
D. tendons and muscle.

10. The structures that constantly carry mucus and foreign particles toward the pharynx are the:

A. sinuses.
B. bronchi.
C. alveoli.
D. cilia.

11. What is the name of the slit that opens into the trachea?

_____

12. The function of the epiglottis is to:

A. remove carbon dioxide from the blood.
B. produce mucus.
C. prevent food from entering the trachea.
D. protect the vocal cords.

THE LUNGS

Goals:

Upon completion of this module, you should be able to:

1. Identify the structure of the lungs.
2. Identify organs and/or structures related to the lungs.

STRUCTURE OF THE LUNGS

Only the mechanical process of conducting air takes place in the upper respiratory tract. Actual respiration, the exchange of gases, takes place in the lungs, which are ideally structured to fulfill this function.

The two lungs entirely fill the chest cavity. Shaped like large blunt cones, they point upward past the clavicles (collarbones) and are broad at their bases, which rest on the upper surface of the diaphragm at about the level of the seventh rib. Because of the position of the liver, the base of the right lung rests higher in the chest than the base of the left lung. Short and broad, the right lung is divided into three lobes. The left lung is divided into two lobes and is longer and thinner, to allow for the space taken up by the heart.

The two main bronchi, which split off from the trachea, connect the upper respiratory tract to the lungs. About one-half inch in diameter, these bronchi resemble the trachea in that they too are made of rings of cartilage. As the bronchi continue to branch off into the lungs, the passageways divide into smaller and smaller passageways so that the entire bronchial system resembles a tree (upside-down). The next branches of this tree are the bronchioles, tiny passageways that reach deep into the lungs to bring air to every possible area. As the tubes divide further and get smaller, they become the terminal bronchioles. Here the walls of the bronchioles lose their cartilage and become thinner, until the walls are simply a single layer of tissue. The smallest twigs of the bronchial trees are the respiratory bronchioles, which lead directly to the functional units of the respiratory system--the alveoli (see Figure 3 on the next page).

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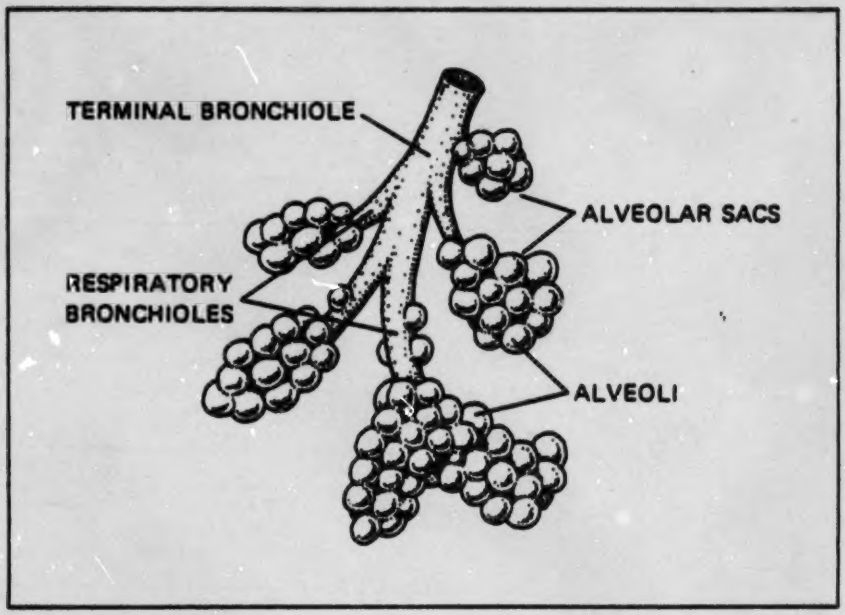

Figure 3. The Terminal Structures of the Respiratory System

Alveoli are microscopic bubbles of very thin tissue clustered around the respiratory bronchioles. Each cluster, or alveolar sac, is made up of many individual alveoli. Because they are clustered, millions of alveoli with extremely thin walls can fit inside the lungs to provide the lungs with a vast inner surface area. This great amount of thin-walled surface area permits diffusion, gas exchange between the lungs and the bloodstream, to take place efficiently.

Because of the thinness of the alveolar walls, the lungs could not support themselves or maintain their shape were it not for the pleurae. These are the membranes covering the outside of the lungs and lining the chest wall. The visceral pleura is always in contact with the lung tissue and rests against the parietal pleura, which lines the thoracic (chest) cavity and diaphragm. Between these two membranes is a thin film of an oil-like substance which binds them firmly together. The rigid chest wall pulls the parietal pleura outward; the parietal pleura pulls on the visceral pleura, which in turn pulls on the lung tissue. This constant pull keeps the thin-walled lungs from folding up and collapsing. Pleural fluid also lubricates the lungs so that they can move in relation to the chest wall with very little friction.

Optional Activities

- Listen to the sounds of breathing with a stethoscope. Are they the same all over the chest and back? Why or why not?

- Discuss how cigarette smoking affects the structures and function of the lungs.

THE LUNGS

Post-Test

1. The bottoms of the lungs rest on the:

   A. intestine.
   B. sternum.
   C. heart.
   D. diaphragm.

2. The thin-walled bubbles in the lungs where gases are exchanged are the:

   A. bronchioles.
   B. turbinates.
   C. alveoli.
   D. cilia.

3. The membranes which connect the lungs to the wall of the chest cavity are the:

   A. pleurae.
   B. cilia.
   C. bronchi.
   D. lobes.

4. Name the two types of pleura contained in the chest cavity.

   _____

   _____

5. A cluster of microscopic alveoli is called an alveolar _____.

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_____.

RESPIRATION

Goals:

Upon completion of this module, you should be able to:

1. Identify the types of respiration.
2. Identify and describe the processes involved in respiration.

TYPES OF RESPIRATION

Respiration, or gas exchange between the blood and body tissues, occurs in two areas: between the lungs and the pulmonary blood supply, and between the bloodstream and the cells of the body.

Internal respiration is the exchange of gases between the blood and body cells. (This process is described in the unit on the circulatory system.) External respiration is the exchange of gases between the blood and the lungs--a process which first requires that oxygen be present in the lungs. The active process of getting air into the lungs is the function of the muscles of respiration.

PROCESSES OF RESPIRATION

The diaphragm is the primary muscle of respiration. It is attached to the bases of the lungs and the lower edge of the ribcage. When the diaphragm is relaxed, as it is when not involved in inspiration, it bulges upward into the chest cavity. When it contracts, the diaphragm shortens and flattens out, pulling downward. Because the lungs are attached to the diaphragm by the pleurae, they too are pulled downward, and their interior space increases. This expansion causes the pressure in the lungs to drop below atmospheric pressure (the pressure on the air in the outside environment). As a result, outside air is forced into the expanded lungs through the upper respiratory tract (inspiration).

In the breathing process, the ribcage works in much the same way as the diaphragm. The ribs are attached to the spine and breastbone in such a way that they are capable of swiveling up and out; muscles called intercostal muscles cause this swiveling motion during inspiration. The effect of this motion is to enlarge the diameter of the ribcage, which expands the entire chest wall. As the chest wall expands, the pleurae cause the lungs to expand with it. Again, the expansion of the lungs causes a drop in internal pressure and the outside air flows into the lungs.

The strength of contraction of the diaphragm and the intercostal muscles changes the amount of air taken in with each breath during inspiration. In quiet breathing, the diaphragm flattens out by only an inch or so, but in heavy breathing it can drop more than three inches. The heaving chest of an athlete who has just run a race is an example of greater-than-normal chest (and therefore lung) expansion, which causes inspiration of greater-than-normal amounts of air.

The amount of air inhaled and then exhaled with each breath is called the tidal volume, because it ebbs and flows. Average resting tidal volume is about 500 cubic centimeters (cc), or about a pint, of air moved by the action of the respiratory muscles. When the need for air is greater, as in stress or exercise, the muscles cause greater chest expansion and the tidal volume increases proportionately. There is always a supply of air left in the lungs which cannot be exhaled. This reserve is called residual volume; it helps prevent the thin-walled passageways of the lungs from collapsing. It is a substantial volume--about 1200 cc, or over a quart. The vital capacity of the lungs is the maximum amount of air that can be forcibly inhaled and exhaled in one breath.

The end of the respiratory cycle is expiration, which eliminates carbon dioxide from the blood and the body. Expiration is normally a passive process: the diaphragm and intercostal muscles relax and the ribcage and chest cavity lose their expansion. The lungs, which are elastic in nature, return to their unstretched size. The waste air is forced out of the lungs and back through the upper respiratory tract to the outside environment. The speed with which the respiratory cycle occurs determines respiratory rate. A normal resting adult usually has a respiratory rate of about 10 to 14 breaths (cycles) per minute.

In summary, the respiratory system takes in air; warms, moistens, and filters it; transports it to the system's functional units, the alveoli; supplies the blood with oxygen; and removes carbon dioxide from the body.

Optional Activities

- Find out how to construct a model of the chest which demonstrates the action of the respiratory muscles on the lungs and the resulting flow of air.
- Measure your respiratory rate before and after exercise. What causes the changes?
- Try to complete the word maze on the following page. It uses some of the terms that you learned in this unit.

WORD MAZE

E	P	I	R	A	G	U	N	G	X	F	O	I	D	R	E
N	A	O	Y	S	U	N	I	S	B	R	E	A	I	C	S
D	H	L	J	O	I	Q	R	Y	N	X	N	E	A	U	I
S	I	N	V	K	S	U	E	L	P	O	P	H	P	A	L
O	A	P	G	E	M	A	N	H	I	M	S	C	H	L	I
V	R	H	K	T	O	D	G	T	O	B	V	A	R	Y	S
H	U	R	W	X	P	L	A	R	Y	N	X	R	A	W	D
E	E	A	F	I	Z	R	I	A	R	O	W	T	G	H	R
A	L	G	O	J	I	K	Z	C	L	C	Q	E	M	A	O
R	P	M	E	P	O	S	T	R	O	C	O	V	A	I	C
Y	A	M	S	T	U	I	Z	U	F	I	M	E	R	X	L
L	S	E	T	R	L	E	O	C	O	L	B	N	T	I	A
U	R	W	S	I	T	T	O	L	G	I	P	E	K	O	C
N	O	U	C	T	D	S	P	J	V	A	Q	U	A	W	O
G	O	D	I	A	P	A	R	U	E	L	V	E	O	L	V
S	N	I	T	R	X	I	L	I	S	B	D	I	Y	B	M

Find the following terms in this maze by circling the words. They may appear frontwards or backwards, vertically, horizontally, or diagonally.

alveoli
cilia
diaphragm
epiglottis
larynx
lungs
pleura
respiration
trachea
vocal cords

RESPIRATION

Post-Test

1. The supply of air that always remains in the lungs is called

   _____.

2. The muscles which elevate the ribs in breathing are the:

   A. pectorals.
   B. turbinates.
   C. cilia.
   D. intercostals.

3. The exchange of gases between the lungs and the blood is called:

   A. external respiration.
   B. oxygen transport.
   C. osmosis.
   D. capillary action.

4. During breathing, outside air is forced into the lungs because of:

   A. a drop in external pressure.
   B. an increase in residual air.
   C. a pressure drop in the chest cavity.
   D. an increase in tidal volume.

5. The maximum amount of air that can be inhaled and exhaled in one breath is called:

   A. tidal volume.
   B. vital capacity.
   C. inspiratory reserve volume.
   D. residual volume.

6. A normal, resting adult breathes about:

   A. 5-9 times per minute.
   B. 10-14 times per minute.
   C. 15-19 times per minute.
   D. 20-24 times per minute.

GLOSSARY

alveolar sac: a cluster of alveoli.
alveolus (pl. alveoli): a microscopic bubble within the lungs where gas exchange takes place.

bronchiole: a smaller division of the bronchi.
bronchus (pl. bronchi): one of the two tubes that branch off the trachea and into the lungs.

chest cavity: the cavity in which the heart and lungs are located.
cilia: hair-like projections from the upper respiratory tract.

diaphragm: the primary muscle of respiration; located between the chest and abdomen.
diffusion: the mixing of materials (especially gases) through the motion of molecules.

epiglottis: an elastic fold of cartilage which guards the opening of the trachea.
expiration: the act of moving air out of the lungs; exhalation.
external respiration: the exchange of gases between the lungs and the pulmonary blood supply.

glottis: the slit-like opening of the trachea.

inspiration: the act of taking air into the lungs; breathing in.
intercostal muscles: muscles which move the ribs in breathing.
internal respiration: the exchange of gases between the blood and body tissues.

larynx: the respiratory organ responsible for voice production.

nasal cavity: the hollow internal structure from the nose to the pharynx.
nostrils: external openings to the nasal cavity.

olfaction: sense of smell.

pharynx: the organ between the oral cavity and the larynx, shared by both respiratory and digestive systems.
pleurae (sing. pleura): membranes attached to the exterior of the lungs and connecting them to the walls of the chest cavity.
pulmonary: of or relating to the lungs.

residual volume: the supply of air which always remains in the lungs.
respiration: the exchange of gases.
respiratory bronchioles: the final subdivision of the bronchial tree; lead directly to the alveoli.

septum: a wall which separates the nasal cavity.
sinuses: hollow chambers surrounding the nasal cavity.

terminal bronchioles: the last division of the bronchioles whose sole function is gas conduction.
tidal volume: the amount of air moved in and out of the lungs in a normal breath.
trachea: the tube which transports air between the larynx and the bronchi.
turbinates: areas within the nasal cavities.

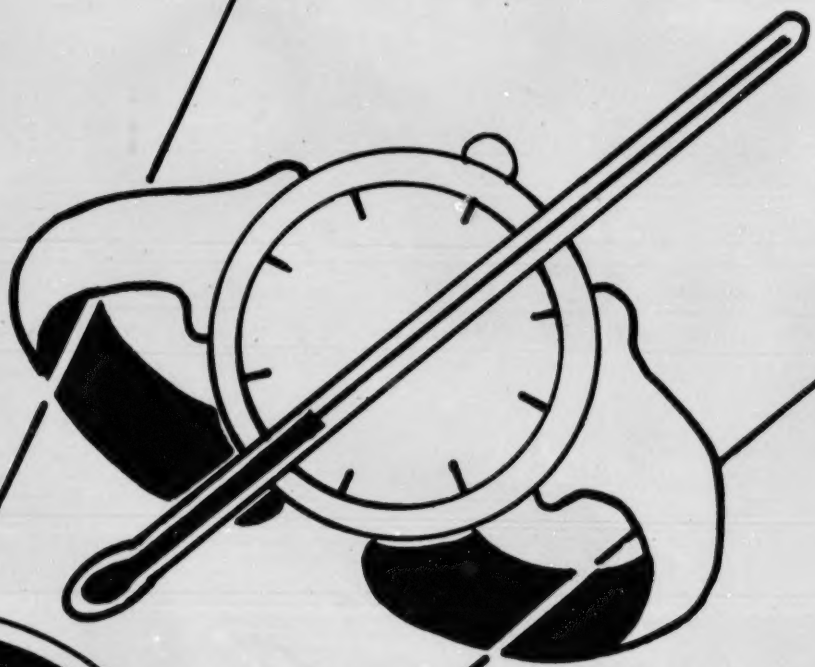
upper respiratory tract: the respiratory passageway from the nostrils to the bronchi.

vital capacity: the maximum amount of air that can be moved through the respiratory system in one breath.
vocal cords: fibrous bands suspended across the larynx which vibrate to produce speech.

ANSWERS TO THE PRETEST

Question	Correct Response
1	C
2	B
3	oxygen
4	D
5	sinuses
6	A
7	vocal cords
8	bronchi
9	B
10	internal, external

/HEALTH OCCUPATIONS EDUCATION MODULE



INSTRUCTOR'S GUIDE
THE RESPIRATORY SYSTEM

Instructional Materials in Anatomy and Physiology
for Pennsylvania Health Occupations Programs

INSTRUCTOR'S GUIDE:

THE RESPIRATORY SYSTEM

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INTRODUCTION

These instructional modular units have been developed for the Pennsylvania Department of Education for use in vocational education programs. They were designed on the assumption that a basic understanding of human anatomy and physiology is essential to any person preparing to enter a health care occupation such as practical nursing, nursing assistant, medical assistant, emergency medical technician, or dental assistant. Each of these modular units will cover the most important aspects of one of the major systems of the human body. In the first four units the following systems will be covered: circulatory system, respiratory system, musculoskeletal system, and digestive system.

This Instructor's Guide is designed to provide suggestions to you on how to use a modular unit most effectively in your instruction. These recommendations, however, do not represent the only way to use these units: you may be able to devise more beneficial uses for the materials.

THE MODULAR UNITS

Each modular unit is made up of several components: a pretest, four to seven instructional modules with corresponding post-tests, optional activities for the students, and a glossary of terms used in the unit. Each of these components has a specific purpose and is organized in a specific way, as will be explained in the following sections.

Pretest

After reading the preface, which is simply an introduction to these instructional units, a student working through a modular unit should first take the pretest. As its name implies, this test is designed to be taken by the student before beginning work on the materials contained in the unit. Its purpose is twofold: (1) to stimulate interest in the modular unit by giving the student a preview of the topics covered, and (2) to provide a means of self-diagnosis so the student may identify, based on performance on the pretest, those areas of the

modular unit which may require special attention and extra effort on the part of the student. After selecting an answer to each of the pretest questions, the student should turn to the back of the modular unit and check the correct answers. If the student answers incorrectly on a number of questions dealing with a particular subject, then the student should pay closer attention to the module on that subject.

Instructional Modules

This modular unit is composed of four separate but closely related modules, including: Introduction to the Respiratory System, Upper Respiratory Tract, The Lungs, and Respiration. After taking the pretest and checking the answers, the student should read through and study each of the instructional modules. For the student's benefit, each module begins with a statement of the goals, or objectives, that a student should have mastered upon completion of that particular module. The level of achievement of these goals is measured by the student's performance on the corresponding post-test. The language level and content of each module is aimed toward the student seeking an introduction to the components, structures, and functions and the basic terminology required for an understanding of the respiratory system.

Optional Activities

Following many modules are optional activities intended to provide the student with an opportunity to pursue the content of the module at a more in-depth level. Many of these activities may require teacher participation, at least in obtaining and preparing additional materials for the student to utilize.

In addition to the optional activities available to the students, you may choose to provide further information to the students by teaching a brief unit on the common disorders of the respiratory system. Discussion of these disorders has not been included in the texts because a basic knowledge of the proper structure and function of the human body in a healthy individual seems more appropriate for the purposes of an introductory program. If you do choose to discuss common disorders, the most effective approach may be one in which you use disorders to illustrate what can go wrong in the body, as a means of clarifying the students' understanding of how the body works when functioning properly.

You may also wish to provide students with the names of books or articles as suggested readings to further their understanding of a particular area.

Glossary

After the last of the modules in the unit is a glossary. This is not intended to be a comprehensive glossary to be used by the student as a dictionary. Rather, it includes the basic terms used in the unit which are necessary to an understanding of the system covered. Those words which appear in the modules and have been defined in the text are not always defined in the glossary. Some of these particular terms have been used in the module because they are essential but difficult terms needed to explain the content taught in the unit. The student should use the glossary to review the vocabulary essential to the unit before taking the post-tests.

Post-Tests

The post-tests are the final assessment of a student's understanding of the material presented in each module. They consist of multiple-choice and open-ended questions designed to measure a student's mastery of the goals (objectives) stated at the beginning of each module. Each of the questions has been written to measure an aspect of the skills and/or knowledge that a student may be expected to acquire as a result of working through a particular module. When a student has finished studying a module, has pursued any chosen optional activities, and has reviewed the vocabulary in the glossary, the student should take the post-test that follows the module.

SCORING THE POST-TESTS

As previously mentioned, the purpose of the post-tests is to measure whether or not a student has mastered the objectives (goals) stated at the beginning of each module. Due to the differing lengths of the post-tests, the variety of ways in which teachers may choose to utilize these modules, and discrepancies among students' previous exposure to the subject matter, it is not practical to set a standard cut-off score on each of the tests that would indicate mastery of the objectives. Rather, teachers are asked to use their professional judgment in individual cases to determine if a student's performance on a post-test indicates that he or she has mastered the objectives stated for that module. In making this determination, you should consider at least all of the following factors:

(1) How long is each post-test?

(2) How much information is included in each module and how complex is the information, relative to other modules?

(3) Has the student been exposed to the kind of curricular material before? That is, has the student been taught the basics of this system of the body before?

(4) Should the entire class be required to achieve a certain score in order to pass, or should each student be considered individually? (This depends on how and with whom you use this module as instructional material.)

(5) Should the student be graded pass/fail on each post-test--i.e., on mastery of each module--or on the unit as a whole?

To facilitate the scoring of post-tests, each student will record his or her answers to all the post-tests on one separate sheet of paper. You should mark each answer correct or incorrect, then give the student a "pass" or "fail" on each module, or on the unit as a whole.

Because of the subject matter, responses to open-ended questions may vary slightly from those listed below, but these responses may also be acceptable. Again, in these cases instructors are asked to use their professional judgment to determine if a response is correct.

Use the following list of answers to questions on the post-tests to grade your students' papers.

ANSWERS TO THE RESPIRATORY SYSTEM POST-TESTS

Module/Question	Correct Response
Introduction to the Respiratory System:	
1	B -- trachea A -- larynx E -- bronchus C -- lung
2	A
3	D
4	A
5	C
6	C
Upper Respiratory Tract:	
1	cilia
2	B
3	A
4	C
5	B
6	B
7	C
8	pharynx
9	B
10	D
11	glottis
12	C

Module/Question	Correct Response
The Lungs:	
1	D
2	C
3	A
4	parietal, visceral
5	sac
Respiration:	
1	residual volume
2	D
3	A
4	C
5	B
6	B